



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/024,359	12/21/2001	Mohammed Asif Khan	8350.0243-00	6525

58982 7590 07/06/2007
CATERPILLAR/FINNEGAN, HENDERSON, L.L.P.
901 New York Avenue, NW
WASHINGTON, DC 20001-4413

EXAMINER

SHARON, AYAL I

ART UNIT	PAPER NUMBER
----------	--------------

2123

MAIL DATE	DELIVERY MODE
-----------	---------------

07/06/2007

PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No. 10/024,359	Applicant(s) KHAN, MOHAMMED ASIF	
	Examiner Ayal I. Sharon	Art Unit 2123	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 11 April 2007.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-60 is/are pending in the application.
 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-60 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 21 December 2001 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
 Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
 Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
 a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date. _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Introduction

1. Claims 1-60 of U.S. Application 10/024,359 are currently pending. The application was originally filed on 12/21/2001.

Claim Rejections - 35 USC § 101

2. 35 U.S.C. 101 reads as follows:

Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

3. **Claims 1-60 are rejected under 35 U.S.C. 101 because the claimed invention preempts a 35 U.S.C. 101 judicial exception. The claims preempt every “substantial practical application” of an idea – a mathematical algorithm.**
4. One may not patent every “substantial practical application” of an idea, law of nature or natural phenomena because such a patent “in practical effect be a patent on the [abstract idea] itself.” Gottschalk v. Benson, 409 U.S. 63, 71-72, 175 USPQ 673, 676 (1972).
5. According to MPEP § 2106 (IV)(C)(3), a claim that recites a computer that solely calculates a mathematical formula (see Benson) or a computer disk that solely stores a mathematical formula is not directed to the type of subject matter eligible for patent protection.
6. All of the claims in the instant application share this defect.

7. The Examiner asserts that the “symbolic processing” of mathematical equations constitutes an abstract idea. Moreover, neither the specification, nor any of the claims are restricted to any field of application, or substantial practical use, that is more specific than “simulating a system”.
8. Moreover, neither the specification or the claims provide a substantial practical use for the claimed invention that is more specific than “simulating a system”.
9. The prior art cited in the 35 U.S.C. § 102 rejections below (see pp.36-37 of the Cellier reference) teaches the use of the claimed subject matter in mechanical, thermodynamic, chemical reaction dynamics, and electrical applications. These different applications share nothing in common other than the underlying math.
10. **Claims 1-60 are also rejected under 35 U.S.C. 101 because the claimed invention is directed to non-statutory subject matter. The claims lack a “concrete, useful, tangible” result.**
11. The claims are directed to methods and apparatuses for “simulating a system”. This claimed subject matter lacks a practical application of a judicial exception (law of nature, abstract idea, naturally occurring article/phenomenon) since it fails to produce a useful, concrete and tangible result as required in State Street Bank & Trust Co. v. Signature Financial Group Inc., 149 F. 3d 1368, 1373-74 (Fed. Cir. 1998) and AT&T Corp. v. Excel Communications, Inc., 172 F.3d 1352, 50 USPQ2d 1447 (Fed. Cir. 1999).
12. The claimed invention as a whole must be useful and accomplish a practical application. That is, it must produce a “useful, concrete and tangible result.” State

Street, 149 F.3d at 1373-74. The purpose of this requirement is to limit patent protection to inventions that possess a certain level of “real world” value, as opposed to subject matter that represents nothing more than an idea or concept, or is simply a starting point for future investigation or research (Brenner v. Manson, 383 U.S. 519, 528-36 (1966)); In re Fisher, 421 F.3d 1365 (Fed. Cir. 2005); In re Ziegler, 992 F.2d 1197, 1200-03 (Fed. Cir. 1993)).

13. The test for practical application as applied by the examiner involves the determination of the following factors:

- **“Useful”** – According to MPEP § 2106 (IV)(C)(2)(2)(a), the USPTO’s official interpretation of the utility requirement provides that the utility of an invention has to be (i) specific, (ii) substantial and (iii) credible. MPEP § 2107 and In re Fisher, 421 F.3d at 1372 (citing the Utility Guidelines with approval for interpretation of “specific” and “substantial”). In addition, when the examiner has reason to believe that the claim is not for a practical application that produces a useful result, the claim should be rejected, thus requiring the applicant to distinguish the claim from the three 35 U.S.C. 101 judicial exceptions to patentable subject matter by specifically reciting in the claim the practical application.
- **“Tangible”** - Applying In re Warmerdam, 33 F.3d 1354 (Fed. Cir. 1994), the examiner will determine whether there is simply a mathematical construct claimed, such as a disembodied data structure and method of making it. If so, the claim involves no more than a manipulation of an

abstract idea and therefore, is nonstatutory under 35 U.S.C. § 101. In addition, According to MPEP § 2106 (IV)(C)(3), a claim that recites a computer that solely calculates a mathematical formula, or a computer disk that solely stores a mathematical formula, is not directed to the type of subject matter eligible for patent protection. Gottschalk v. Benson, 409 U.S. 63 (1972).

- **“Concrete”** - According to MPEP § 2106 (IV)(C)(2)(2)(a), a claimed process must have a result that can be substantially repeatable, or the process must substantially produce the same result again. In re Swartz, 232 F.3d 862, 864 (Fed. Cir. 2000) (finding that an asserted result produced by the claimed invention is “irreproducible” claim should be rejected under section 101). The opposite of “concrete” is unrepeatable or unpredictable. An appropriate rejection under 35 U.S.C. § 101 should be accompanied by a lack of enablement rejection, because the invention cannot operate as intended without undue experimentation.

14. An example of a concrete, useful, tangible result is provided in State Street, 149 F.3d at 1373-74, 47 USPQ2d at 1601-02. (“[T]he transformation of data, representing discrete dollar amounts, by a machine through a series of mathematical calculations into a final share price, constitutes a practical application of a mathematical algorithm, formula, or calculation, because it produces ‘a useful, concrete and tangible result’ – a final share price momentarily

fixed for recording and reporting purposes and even accepted and relied upon by regulatory authorities and in subsequent trades”).

15. Another example of a concrete, useful, tangible result is provided in AT&T, 172 F.3d at 1358, 50 USPQ2d at 1452 (Claims drawn to a long-distance telephone billing process containing mathematical algorithms were held patentable subject matter because the process used the algorithm to produce a useful, concrete, tangible result - a primary inter-exchange carrier ("PIC") indicator - without preempting other uses of the mathematical principle).

16. The claimed subject matter does not produce a useful or tangible result:

- A **“Useful”** result is missing because the claimed subject matter fails to sufficiently reflect at least one practical utility set forth in the descriptive portion of the specification. More specifically, both the described practical utility in the specification, and the claimed subject matter relate ONLY “simulating a system”, which is not a specific or substantial practical utility.
- A **“Tangible”** result is missing because the claimed subject matter fails to produce a result that is limited to having real world value rather than a result that may be interpreted to be abstract, such as a thought, a computation, or manipulated data. More specifically, the claimed subject matter provides for “generating an output that simulates a system”. The output of a mathematical formula reads on this limitation. This produced result remains in the abstract and, thus, fails to achieve the required status of having real world value. Moreover, the claims that recite a computer

that solely calculates the mathematical formula, or a computer disk that solely stores a mathematical formula, are not directed to the type of subject matter eligible for patent protection.

17. Figures 1-2 and 4-6 are flowcharts of the claimed embodiments for "simulating a system". These figures, and their associated text are directed to purely mathematical algorithms. See, for example, Figures 4 and 6. No specific substantial practical application is recited in specification, or in the claims.

Claim Rejections - 35 USC § 103

18. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

19. The prior art used for these rejections is as follows:

- Cellier, F.E. and H. Elmqvist. "Automated Formula Manipulation Supports Object-Oriented Continuous-System Modeling." IEEE Control Systems Magazine. April 1993. Vol.13, Issue 2, pp.28-38. ("Cellier").
- Pantelides, C., "The Consistent Initialization of Differential-Algebraic Systems", SIAM Journal of Scientific and Statistical Computing, Vol. 9, 1988, pgs. 213-231. ("Pantelides". Cited by Applicant in IDS filed 12/21/2001).

20. Claims 55-58 are rejected under 35 U.S.C. 103(a) as being unpatentable over Cellier in view of Pantelides.

21. In regards to Claim 55, Cellier teaches the following limitations:

- 55. A method of simulating a system, comprising:
 - establishing equations modeling the system using terms having characteristics encapsulated within the terms;
 - ...
 - performing system processing on the established equations for efficient simulation, and
 - wherein performing system processing includes processing a first set of equations including equations modeling the system and initial condition constraints and processing a second set of equations including equations modeling the system and numeric integration equations.

See Cellier, especially: pp.35, left column, to p.37. Cellier, however, does not expressly teach the following limitation:

- performing symbolic processing on the established equations for reducing the number of terms in the equations; and

Pantelides, on the other hand, expressly teaches that limitation.

Cellier and Pantelides are analogous art because they are from the same field of endeavor, solving differential equations.

At the time of the invention, it would have been obvious to a person of ordinary skill in the art to modify the teachings of Cellier with those of Pantelides by implementing the elements of the Pantelides algorithm.

The suggestion/motivation for combining the references is expressly stated in p.35 of the Collier reference, which expressly teaches that "This algorithm has been implemented in Dymola."

Therefore, it would have been obvious to a person of ordinary skill in the art to modify Collier with Pantelides to obtain the invention as specified in Claims 55-58.

22. In regards to Claim 56, Cellier teaches the following limitations:

56. The method of claim 55, further including:
defining a term group including one or more terms having related functionality;
evaluating each term within the term group upon an initial request for evaluation of any of the one or more terms within the term group; and
storing the result of the evaluation for each of the one or more terms within the term group.

(See Cellier, especially: pp.35-37)

23. In regards to Claim 57, Cellier teaches the following limitations:

57. The method of claim 56, further including:
recalling the stored value of the evaluated one or more terms from the term group upon a subsequent request for evaluation of the one or more terms, without performing the evaluation stage.

(See Cellier, especially: pp.35-37)

24. Claim 58 is rejected based on the same reasoning as claim 55. Claim 58 is a method claim that recites limitations equivalent to those recited in method claim 55 and taught throughout Cellier.

Response to Amendment

Re: Claim Objections

25. Examiner finds that applicant's amendment filed on 4/11/2007 has overcome the objections to minor informalities in claims 1 and 23. The objections have been withdrawn.

Re: Claim Rejections - 35 USC § 101

26. Applicant's response to the 35 USC § 101 is not persuasive. First of all, applicant's response in pages 21-23 of the amendment filed 4/11/2007 does not refute the rejections based on the issue of preemption – that the claims preempt every “substantial practical application” of an idea (in this case, a mathematical algorithm). This issue was raised in paragraphs 6-12 of the Non-Final Office Action mailed 2/20/07.
27. In fact, applicant's response supports this rejection by arguing that “[m]any different types of systems have complex behaviors that can be described in terms of a system of differential algebraic equations (DAE). For example, a backhoe loader has an excavation arm ...” The original rejection from the Non-Final Office Action mailed 2/20/07 (see p.4, paragraph 12) explained that the prior art cited in pp.36-37 of the Cellier reference taught the use of the differential equations in mechanical, thermodynamic, chemical reaction dynamics, and electrical applications. These different applications share nothing but the underlying math, thereby showing that the claims attempt to preempt the use of all “substantial practical applications” of the math.
28. Moreover, applicant's arguments about the “backhoe loader” (see p.22 of the amendment filed 4/11/07) are directed to features (i.e., the “backhoe loader”) which are not recited in the rejected claims. Although the claims are interpreted

- in light of the specification, limitations from the specification are not read into the claims. See *In re Van Geuns*, 988 F.2d 1181, 26 USPQ2d 1057 (Fed. Cir. 1993).
29. In addition, applicant refers to the claims of U.S. Patent 6,810,370 as an example of claims directed to a physical system. The Examiner cannot comment on the validity of an issued U.S. patent, and will not give the issued patent any weight in regards to the patentability determination of the instant application.
30. Finally, Examiner disagrees with applicant's assertion that "the claims recite a 'concrete, useful, tangible' result." In an attempt to claim all substantial practical applications of the underlying math, the applicant has refrained from reciting any practical application in the claims. Instead, the applicant argues a specific application (i.e., the "backhoe loader") that is not recited in the rejected claims.
31. Examiner is therefore maintaining the 35 USC § 101 rejections.

Re: Claim Rejections - 35 USC § 103

32. Examiner finds applicant's arguments filed on 4/11/2007 to be persuasive regard claims 1-54 and 59-60, and has withdrawn the relevant rejections based on Cellier in view of Pantelides.
33. In particular, Examiner was persuaded by the following argument on pp.24-25 of the amendment, regarding the rejections of independent claims 1, 23, 43-45, and 49,:

Although Pantelides refers to a "row rank" on pages 215 and 221, a row rank is wholly unrelated to "eliminating an integral ... wherein eliminating an integral includes assigning a preferred integration location rank to one or more integrals," as required by claims 1, 23, 43-45, 49, 55, 58 and 59.

A row rank refers to the number of rows in a matrix. For example, Pantiledes teaches that the "row rank" of the matrix C, or the number of rows therein, defines the number of new equations which the original variable set must satisfy. Pantelides, at 215.

34. In regards to claims 55-58, however, applicants arguments were directed to limitations that do not appear in those claims. The rejections, therefore, are maintained.

35. Examiner was also persuaded by the following argument on p.26 of the amendment, regarding the rejections of independent claims 53 and 54:

However, Cellier does not teach that block variables are identified in the system of equations or subsets thereof, nor that the solvability of the equations are determined. Further, Cellier does not teach solving the equations using nonlinear iterates and block variables, nor that the system of equations is scanned for solved variables for identification of variables that are independent and may be removed from the block. Pantelides also fails to remedy the deficiencies of Cellier.

Conclusion

36. The following prior art, made of record and not relied upon, is considered pertinent to applicant's disclosure.

37. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory

Art Unit: 2123

action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Correspondence Information

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Ayal I. Sharon whose telephone number is (571) 272-3714. The examiner can normally be reached on Monday through Thursday, and the first Friday of a bi-week, 8:30 am – 5:30 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Paul Rodriguez can be reached at (571) 272-3753.

Any response to this office action should be faxed to (571) 273-8300, or mailed to:

USPTO
P.O. Box 1450
Alexandria, VA 22313-1450

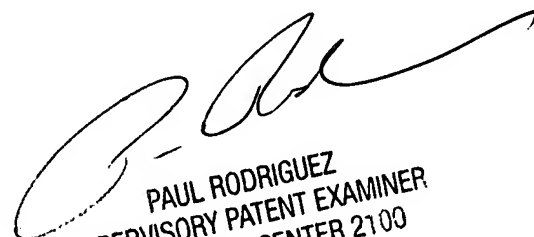
or hand carried to:

USPTO
Customer Service Window
Randolph Building
401 Dulany Street
Alexandria, VA 22314

Art Unit: 2123

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the Tech Center 2100 Receptionist, whose telephone number is (571) 272-2100.

Ayal I. Sharon
Art Unit 2123
June 26, 2007



PAUL RODRIGUEZ
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 2100